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Biologicals

Biologicals Solutions and Regenerative Agriculture

MEGAFOL™

Innovation
powered by nature

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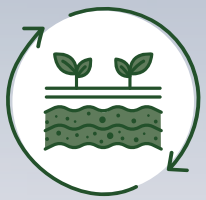
Biologicals' four benefits to Regenerative Agriculture



Healthier soils

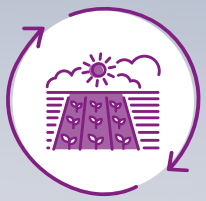
Biologicals can help improve the biochemical activity of the soil, contributing to its capacity to function as a vital living ecosystem that sustains the life of plants, animals, and humans.

Reduced greenhouse gas emissions

The integration of biological inputs in crop management can help contain emissions through a more efficient use of resources and an increase in productivity.

Better water management

Biologicals for water use efficiency help farmers optimize the use of agricultural water, making the most of this precious resource.



Increased farm productivity and profitability

Biologicals can help crops be more productive and face the abiotic and biotic stresses that jeopardize their yield and quality, therefore protecting farmers' incomes and limiting the expansion of agricultural land.

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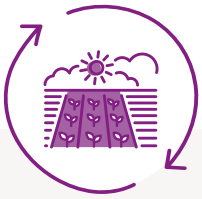


Biologicals Solutions for Regenerative Agriculture: MEGAFOL™

Summary

Rethinking Agriculture

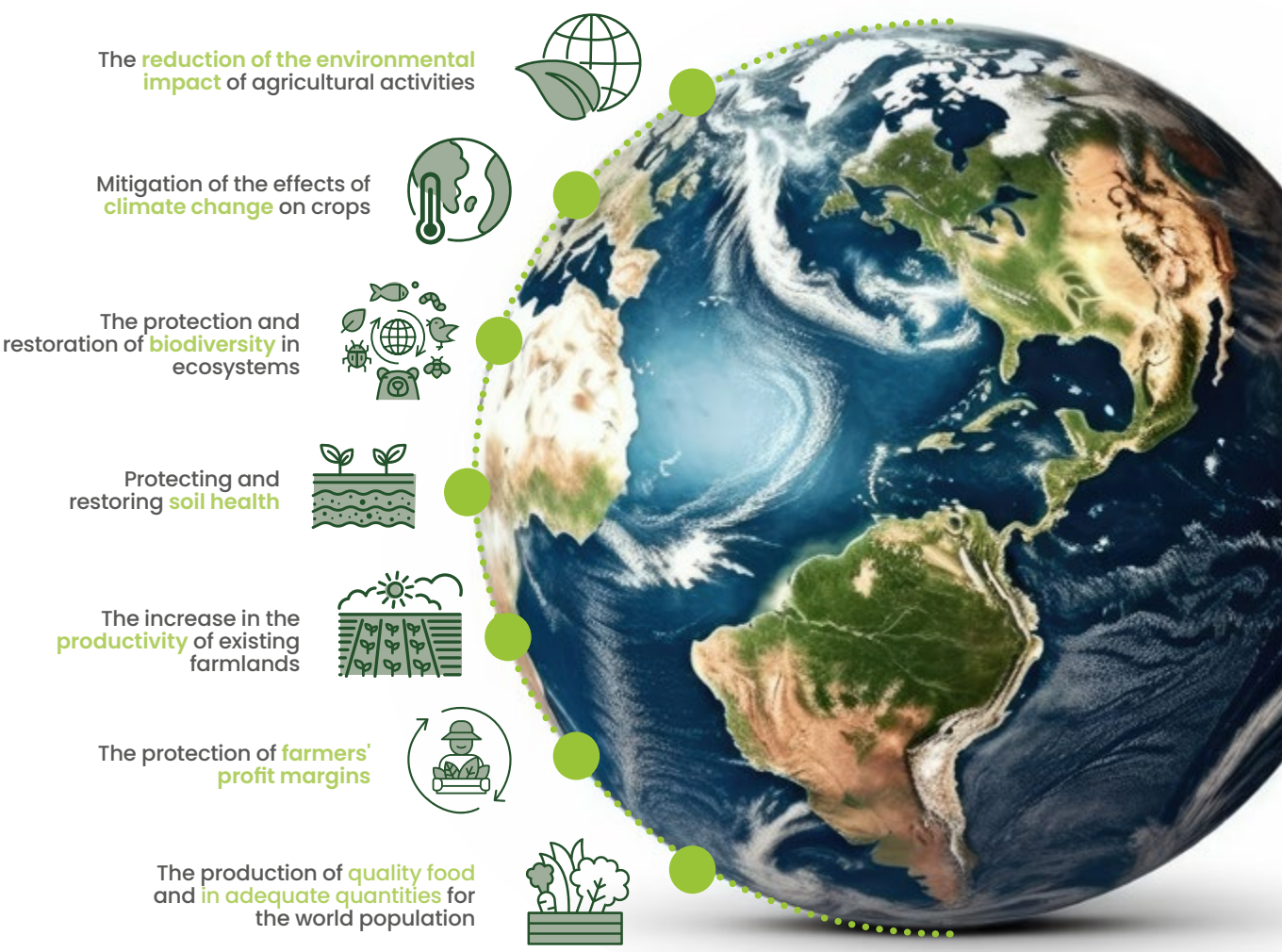
The availability of food for the whole world depends, directly or indirectly, on agricultural production.
The increase in crop productivity achieved over the last century has alleviated poverty and malnutrition around the world, and, at the same time, has made it possible to limit the conversion of habitable land for agricultural purposes to feed a growing population.
However, this success was only temporary. The combined effects of global warming, scarcity of resources and population growth, which reached 8 billion in 2022, now make it necessary to **rethink the way we produce food. Guaranteeing enough healthy food for the entire world population, and, at the same time, limiting the consumption of resources and safeguarding the health of plants, soil and ecosystems:** this is the challenge that modern agriculture is facing, a challenge that requires a rigorous approach and globally coordinated measures.

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

To drive change, the United Nations has dedicated a goal of the Sustainable Development Goals (UN-SDGs) to food production, number 2, which aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture".
However, as a confirmation of the central role that agriculture occupies in our society, and its transversal impacts, the goals connected to the production of food among the UN-SDGs are the majority, and are distributed among objectives of an environmental, social and economic nature.
In this complex and interconnected panorama, **all the players in the food chain will have to find effective and innovative solutions to face the challenge that awaits us.**
Solutions leveraging both on the imperative of ecosystems conservation and on the answers provided by scientific innovation.

What is Regenerative Agriculture?

We define regenerative agriculture as an **outcome-based** approach, that is to say, oriented towards obtaining specific agronomic and ecological results. Some of these objectives are:



At the same time, we identify **principles and practices** that are functional to achieving these goals. According to the principles of regenerative agriculture, **traditional practices** such as minimal or no-tillage, the use of cover crops, or crop rotation meet with **innovative solutions and technologies** in accordance with the specific needs of crops and land, to tailor an approach that is simultaneously beneficial to humans, the environment and the entire value chain.

This strategy supports the UN-SDG Objective n.2 in its promotion of a "sustainable agriculture", with the idea that **only by safeguarding the well-being of the environment and of the crops themselves it is possible to obtain results that are sustainable in the long term from an economic, social and environmental point of view**.

Regenerative Ag in Germany: example

+60%
profits for farmers*

annual **GHG savings** of
35 million
tons**

socio-economic **benefits**
8.5 billion
euros a year

* in the medium/long term

** Equivalent to the emissions of 1/3 of German private car traffic

Report from BGC Nabu, 2023

The role of Biologicals in Regenerative Agriculture

Regenerative agriculture requires rethinking not only the way of cultivating the land, but also the systemic agronomic strategy and the use of external inputs for crop nutrition and protection. The latter are still considered, but managed in the principle of **precision application**: administered in a targeted way, minimizing waste, and leveraging on the most innovative technologies to optimize treatments on the basis of the single crop or area.

In this context, an important help is provided by **Biologicals**, innovative products that **valorize the action of molecules and organisms present in nature** with the aim of improving crop performance and soil quality. These solutions are designed on

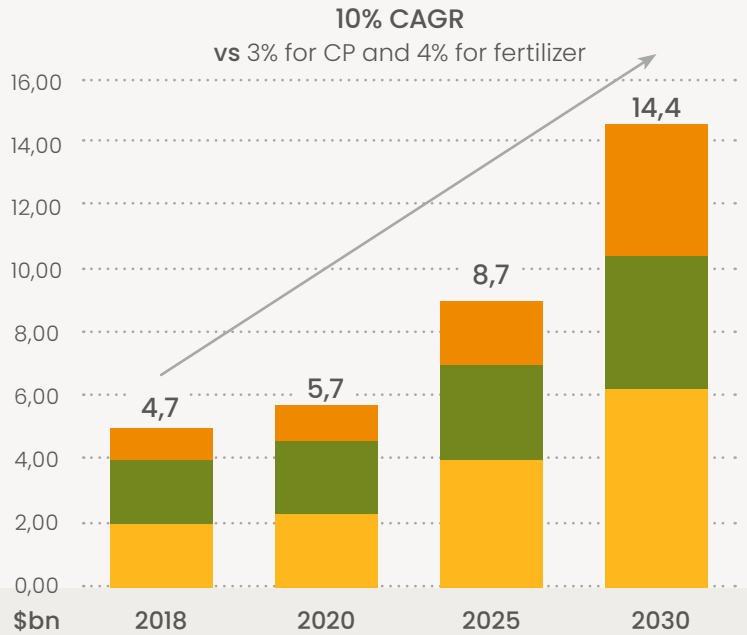
the basis of a **deep knowledge of the chemical and biological mechanisms underlying the physiology of plants** and their interactions with the environment, to ensure their **health and productivity** while respecting ecosystems.

Biologicals are made up of two main categories: **Biostimulants and Biocontrol**. The former improve the natural physiological processes of crops to increase their **quality, resilience to climatic stress and efficiency in the use of resources**, also benefiting the **microbial activity of the soil**; the latter help plants to face and overcome the pitfalls posed by **weeds or parasites**.

Biologicals are not born as alternative solutions to traditional inputs, but to be used in synergy with them and to optimize their use. In particular, Biostimulants improve the health and nutrition status of plants; by doing so, they allow crops to better react to adverse climatic events, or, depending on the type of product, to make the best use of the available resources, minimizing the waste of nutrients. In addition, Biofertilizers – often considered part of the Biostimulant category - can positively affect soil quality by improving the microbial processes that lead to the formation of nutrients.

Products in the Biocontrol category, on the other hand, exploit molecules and substances present in nature to implement highly targeted, specific and low-impact crop defense strategies. An example is the use of pheromones, chemical substances used by parasites for signals between individuals, used to alter reproductive behavior in areas of agricultural interest without harm to the surrounding environment.

Market perspectives reflect farmers' increasing interest in Biologicals.



Biostimulants
Biocontrols
Biofertilizers

As many companies in the food chain are committing to regenerative agriculture for sustainable commodity sourcing, Biologicals can be an important tool in the farmers' toolbox to meet the demands of an increasingly sustainability-demanding market and become chosen partners of a sustainable food chain.

MEGAFOL™ for Regenerative Agriculture

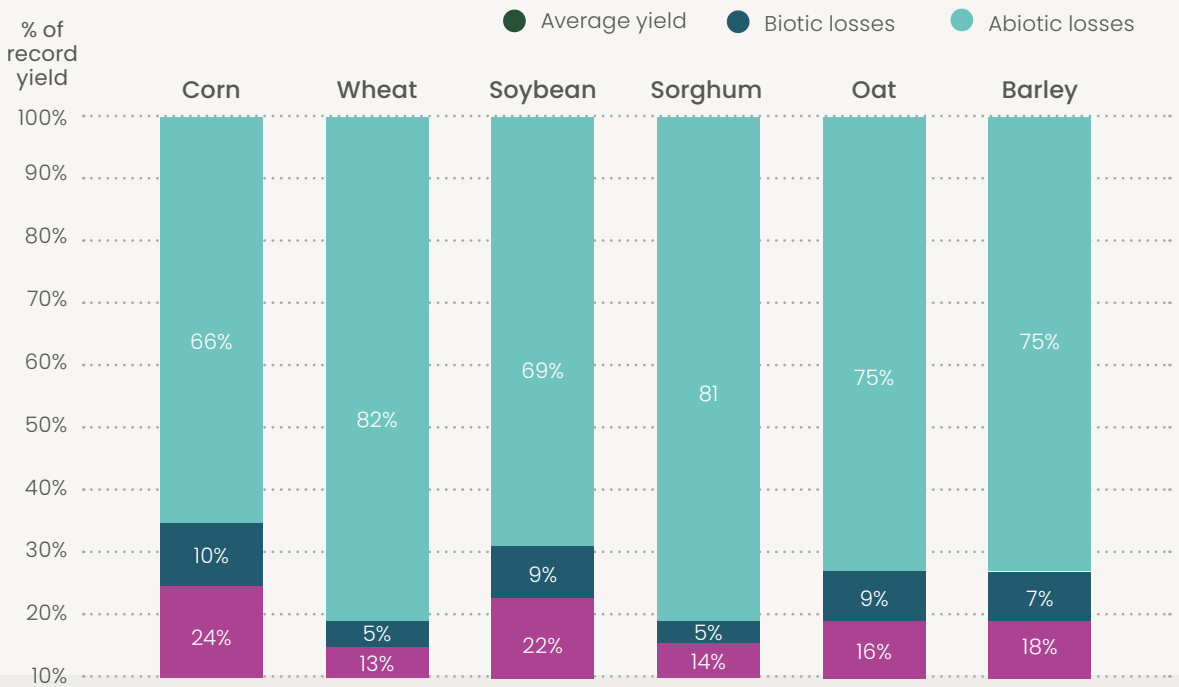
MEGAFOL™ is an anti-stress and growth activator biostimulant that allows plants to fully express their yield potential under stressful conditions, preserving quality and quantity of yields and helping crops deal with the effects of climate change.

Abiotic stress as a threat to global food security

Phenomena such as drought, extreme heat or cold, excess salinity, soil mineral deficiency and soil toxicity are among the most impactful environmental stresses for crops and have severe economic repercussions on farmers' income. Due to the effects of climate change and the related occurrence of more frequent episodes of extreme weather conditions, these phenomena are becoming more frequent and severe in many regions of the world, putting food production and security at risk.

Abiotic stress, the negative impact on crops caused by environmental and non-living factors, constitutes a major limitation to agricultural production. Studies estimate that abiotic stress is the underlying cause for around 70% of yield loss among major crops.

Yield impact from abiotic losses for major crops.



Source: Biochemistry and Molecular Biology of Plants, Buchanan, Gruissem, Jones, American Society of Plant Physiologists, 2000.

Abiotic stress causes around **70%** of yield reduction

Many crops do not reach **20%** of the production potential

In this already challenging panorama, climate change complicates matters further. While the Intergovernmental Panel on Climate Change (IPCC) projected in 2007 that climate change would lead to net global yield gains in 2050, as temperate zones would have benefitted from more beneficial conditions for cropping, the same organism was later led to revise this optimistic projection. Their 2014 report show wide consensus among scientific studies on the fact that, over 1960–2013, **negative impacts of climate change on crop yields have been more common than positive impacts**, the fewer positive impacts being related mainly to high-latitude regions.

The ways in which climate change is jeopardizing yields are multiple, and changes in temperature and weather patterns play a major role. **Several studies demonstrate that the occurrence of exceptionally high temperatures at critical periods of growth have direct, negative effects on the growth and yields of some crops**. In addition, higher temperatures are linked to loss of water from soils and plants, and overall drier conditions, resulting in shorter growing seasons and increasing the risk of crop failures. Finally, **climate change is also heavily affecting rainfall patterns**, with an increased occurrence of drought periods and intense storms, and consequent severe issues related to floods and erosion.

In the light of this, the topic of abiotic stress in agriculture is gaining more and more attention, and, not by chance, **the resilience increase to climate change in crops is often mentioned among the objectives of Regenerative Agriculture**. However, this attention does not necessarily lead to the adoption of targeted agricultural practices: while farmers normally use crop protection solutions to reduce losses due to biotic stress like pests, weeds or parasites, **solutions that address abiotic stress are often still overlooked**.

For this reason, **it is important to increase farmers' awareness on the available practices and solutions that make farming more resilient to environmental stresses, and that help crops remain productive and profitable in spite of climate change**.

MEGAFOL™: anti-stress and growth activator

When applied in times of stress such as frost, root asphyxia, weeding, or hail, MEGAFOL™ allows plants to quickly overcome the stress and improve growth, giving farmers a useful tool to manage their crops in a climate-resilient way.

The presence of specific active ingredients in MEGAFOL™ makes it a useful solution to reduce the impact of stressful conditions on plant growth. They act as **organic osmolytes**, meaning that they are involved in maintaining cell volume and protecting the integrity of cell walls jeopardized by **osmotic stress** (water and electrolyte imbalances), **drought, salinity and high or low temperatures**. The intracellular accumulation of organic osmolytes favors water retention within the cells, protecting them from dehydration by regulating the opening of the stomata (pores in leaves controlling the rate of gas exchange) and the permeability of the membrane. **Furthermore, MEGAFOL™ helps also protect the quality and quantity of production that is put at risk by stressful events.**

The presence of specific active ingredients in the product provides for optimal safeguarding and quick recovery of the main metabolic functions. The product helps crops mantain the amino acid reserves and has a role in the increase in growth and production, as well as in the increase in the photosynthetic activity of the plant.

In the light of these effects, investigated by means of high-level technologies (Petrozza et al., 2014), MEGAFOL™ can significantly help farmers tackle the effects of abiotic stress on crops, make farming more climate-resilient and profitable especially in a context where climate change is severely affecting yields.

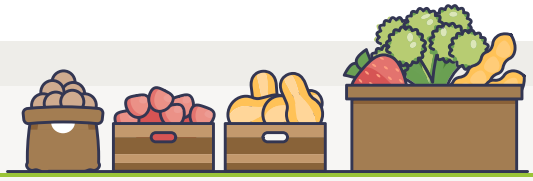
As such, this solution can give a significant support to the Regenerative Agriculture outcomes, especially (but not limiting to) in regard to increased farm productivity:

Mitigation of the effects of climate change on crops as it contributes to making crops more climate-resilient and overcome with success the stressful situations that jeopardize their growth and yield.

Production of quality food and in adequate quantities for the world population as it secures yield and quality in spite of the effect of climate change.

On the field

Key crops performances



Total average yield increase on all crops refers to selected trials done with Megafol™*

Crops	Average Yield Increase (ton/ha)	ROI**
Corn	0,41	3:1
Fresh Tomato	2,05	18:1
Lettuce	1,31	21,7:1
Melon	2,14	15,6:1
Oilseed Rape	0,12	3,4:1
Olive	0,65	6,1:1
Onion	1,21	6,5:1
Peach	1,56	15,5:1
Pepper	1,44	8,1:1
Potato	2,88	7,3:1
Processing Tomato	5,39	3,9:1
Soft Wheat	0,35	5,3:1
Soybean	0,15	3,7:1
Table Grape	1,84	15,8:1
Wine Grape	0,71	4,4:1

*850 selected trials for the summary in the table, of which 68% were carried out under abiotic stress conditions.

**Return on investment (ROI) is calculated by dividing the profit by the related investment, based on an average value in the European market.

Cultivating Sustainability

Sustainable practices and use of products such as Biologicals are good enablers of regenerative agriculture, but this is still not enough! First and foremost, a culture of sustainability must be cultivated along the whole supply chain, leading to a deeper awareness of the issues that we are facing, their repercussions on a global scale, and what tools can be used to address them. In addition, Biologicals such as TALETE™, although actually simple to use, require training and technical assistance for an optimal result configured on the precise needs of the customer. **For this reason, we devote ourselves to providing farmers frequent technical trainings on the use of Biologicals solutions in the framework of Regenerative Agriculture.** From region to region, a special focus is put on the management of the local key crops and the main pain points for farmers, in order to close the knowledge gap that often hinders the adoption of new sustainable practices and products. In addition, **we guarantee a system of continuous, widely distributed on-field support**, with a technical support team composed of experienced specialists in the field of Biologicals, competent in the agronomic field and, at the same time, **trusted advisors for customers from plantation to harvest**. These figures, combining excellent technical, commercial and human skills, have a strategic role in creating a link between the technology and its use, contributing to the goal of spreading Regenerative Agriculture practices, in order to create strategies that combine environmental and economic sustainability while respecting margins.

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